cont A4

tetrachloride, monochlorobenzene, dichlorobenzene, pentane, hexane, cyclohexane, heptane, and octane.

A5

16. (Amended) The method of producing 2-alkyl-4-isothiazoline-3-one stated in Claim 15 in which aforementioned solvent is selected from at least one of the following: Dichloromethane, dichloroethane, trichloroethane, tetrachloroethane, chloroform, carbon tetrachloride, monochlorobenzene, dichlorobenzene, pentane, hexane, cyclohexane, heptane, and octane.

REMARKS

The Official Action mailed December 3, 2001 has been received carefully reviewed. Claims 1, 4, 8, 12, and 16 have been amended. Thus claims 1-19 are now pending in the present application.

The Examining Attorney has rejected claims 1-19 under 35 U.S.C. § 112, second paragraph. Applicants have amended claims 1, 4, 8, 12, and 16 in substantial accordance with the Examiner's suggestion, without broadening the scope of claims. Specifically, Applicants have deleted the parentheses embracing the R variable definition and replaced the phrase "characterized by the fact that" with "wherein" in claim 1. In addition to those amendments suggested by the Examiner, Claim 1 has also been amended to rephrase the wording therein, for reasons unrelated to patentability. Support for the this amendment can be found on page 8, lines 16-24. Further, Applicants have added the word "and" before the word "octane" in claims 4, 8, 12, and 16. Accordingly, Applicants respectfully request that the rejection under §112 be reconsidered and withdrawn.

The Examiner has rejected claims 1-17 under 35 U.S.C. 102(b) as being anticipated by GB 2,2308,364 to Kim et al. Specifically, the Examiner alleges that Kim et al. disclose, in Example 1, Example 3, etc., disclose the processes which are embraced by the instant application.

An anticipation rejection under 35 U.S.C. 102(b) requires a showing that each limitation of a claim must be found in a single reference. *In re Donohue*, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985). Contrary to the Examiner's assertion, it is respectfully submitted that Kim et al. does not disclose each limitation of claims 1-17. Specifically, Kim et al. fail to disclose a method of producing a mixture containing the compound 2-alkyl-4-isothiazoline-3-one wherein (1) either

formula (I) or formula (II), as described in the subject application, is reacted with a solvent in which hydrogen chloride is insoluble or has low solubility, as described in claim 1, and (2) wherein the either formula (I) or (II) is reacted with a ratio of two mol equivalents of chlorinating agent per mole of compound of formula (I) or three mol equivalents of chlorinating agent per mol of formula (II), as described in claim 1. These novel features of the Applicants' invention allow for the efficient production 2-alkyl-4-isothiazoline-3-one with no or a very limited quantity of 5-chloro-2-alkyl-4-isothiazoline-3-one. By employing a solvent that is insoluble to hydrogen chloride or has a low solubility in hydrogen chloride, 2-alkyl-4-isothiazoline-3-one.HCl can be converted to 2-alkyl-4-isothiazoline 3 as described on page 10, line 24-28.

Kim et al. do not disclose the aforementioned limitations, either explicitly or inherently in GB 2308364. Exclusion of a claimed element from a prior art reference is enough to negate anticipation by that reference. *Atlas Powder Co. v. E.I. du Pont De Nemours & Co.*, 224 U.S.P.Q. 409, 411 (Fed. Cir. 1984). Since the claims 2-17 are ultimately dependent on claim 1, and therefore contain the limitations thereof, Kim et al. is not anticipate claims 1-17 and is, therefore, an improper reference under § 102.

For argument sake, even if Kim et al. disclosed the limitations recited in Applicants' claims, which it does not, the elements are not found in the same situation where they perform the same function. See *AMI Indus., Inc. v. EA Indus, Inc.* 204 U.S.P.Q. 568, 586-87 (not only must all claimed elements be present in the reference, but the elements must be found in substantially the same situation where they do substantially the same work.) As explained by Applicants, there is a high demand for an industrial solvent, specifically 2-alkyl-4-isothiazoline-3-one, that does not contain 5-chloro-2-alkyl-4-isothiazoline-3-one, a compound known to cause mutagenicity. (See p. 1, line 12-19). Therefore, one objective of the present invention is to provide a method of obtaining a high-purity 2-alkyl-4-isothiazoline-3-one in a profitable yield through an industrially simple method, which does not contain 5-chloro-2-alkyl-4-isothiazoline-3-one or contains it at a level low enough so as not to bring about mutagenicity. (See p. 3, lines 11-16).

Contrarily, the objective of Kim et al. is the preparation of a mixture consisting of both 2-methyl-4-isothiazoline-3-one and 5-chloro-2-methyl-isothiazoline-3-one, which is substantially free of 4,5-dichloro-2-methyl-4-isothiazoline-3-one, a compound with known toxicity. 5-chloro-

2-methyl-isothiazoline produced by the method of Kim et al. is substantially equivalent to 5-chloro-2-methyl-isothiazoline-3-one sought to be avoided by Applicant, in both chemical structure and activity. Therefore, the reactive components taught by Kim et al. do not function in the same manner, as dictated *AMI Indus., Inc.* Specifically, Kim et al. discloses a method of producing a mixture preferably containing 5-chloro-2-methyl-4-isothiazoline-3-one, whereas the present invention, on the other hand, provides for a method of producing a mixture substantially devoid of 5-chloro-2-alkyl-4-isothiazoline-3-one. Therefore, Kim et al. is not a valid reference under 35 U.S.C. §102.

The Examiner has also rejected claims 1-19 under 103(a) as being unpatentable over Kim et al. (GB 2,308,364), Hahn et al. (U.S. Pat. 5,453,507), Lewis et al. (U.S. Pat 3,849,430) and Burri (Helvetica Cahimica Acta, Vol. 72 (1989)), each taken alone or in combination with each other. For substantially the same reasons as discussed above, Kim et al. is not a valid reference under 35 U.S.C. §103(a). Particularly, the teachings disclosed by Kim et al. and Applicant are clearly inconsistent. As stated earlier, Kim et al. teaches a method whereby a mixture of 2-methyl-4-isothiazoline-3-one and 5-chloro-2-methyl-4-isothiazoline-3-one is obtained that is substantially free of 4,5-dichloro-2-methyl-4-isothiazolin-3-one. This objective is entirely inconsistent with the teaching of the present invention, namely, the production of 2-alkyl-4-isothiazoline-3-one that contains only a very small quantity of 5-chloro-2-alkyl-4isothiazoline-3-one, if any. Unlike in the present application, Kim et al. do not disclose a method whereby 2-methyl-4-isothiazoline-3-one can be produced in isolation.

With respect to the disclosure of Hahn et al., the Examiner points Col. 3, lines 49-57, in further support of the rejection under 35 U.S.C. §103(a). As provided in the present application, the results of Applicants' experiments revealed the unanticipated fact that the selectivity of 2-alkyl-4-isothiazoline-3-one and 5-chloro-2-alkyl-4-isothiazoline-3-one produced varies with the type of solvent used in the reaction and the molar ratio of reactants formula (I) and formula (II) to chlorinating agent. The correlation between solubility of the hydrogen chloride in the solvent used in the reaction was discovery that led to the present invention (See page. 3, line 20-29).
The cited references do not teach or suggest these incorporation of these limitations to produce the results of the present invention. Accordingly, Neither Hahn et al., taken alone or in combination with the other cited references renders Applicants' invention obvious.

The Examiner further points to Example 1 in column 4 of the Hahn reference as an illustration of a reaction that is allegedly similar to the method of the present invention. However, the Examiner has seemingly overlooked the fact that Hahn et al. have not isolated a 2-methyl-isothiazolin-3-one in pure form as have done the Applicants. Hahn et al. have only isolated the salt of 2-methyl-isothiazolin-3-one, namely, 2-methyl-4-isothiazoline-3-one.HCl. (See Example 1, line 27). Again, it is the use of a solvent in which hydrogen chloride is insoluble or has a low solubility that one patentably distinct aspect of the present invention. Using such solvents, the hydrochloride salt obtained as the final product, as described in Hahn et al. (See Example 1, line 27), can be neutralized to 2-alkyl-4-isothiazoline-3-one. Moreover, this process can be completed in the absence of any significant loss the desired compound.

The nonobviousness of the present invention is further supported by a comparison of the results shown on page 14, Table 2 of the present application with the mol % obtained via the method of Hahn et al., as shown in Examples 1-17, etc. Column 6-8. The method of the present invention yields a 2-alkyl-4-isothiazoline-3-one mol % of >99.9. Example 1 of Hahn et al. cited by the Examiner on the other hand yielded a product return of only 90 mol %. (See Hahn et al., Example 1, Column 4). The unexpected superior results attained by the method of the present invention are substantial, strongly indicating that the present invention would not have been obvious to one of ordinary skill in the art in view of Hahn et al., alone, or in combination with any of the other cited references, at the time the present invention was made.

For substantially the same reasons as discussed above, with respect to the disclosures Hahn et al., applicant respectfully submits that the disclosures of Lewis et al. (U.S. Pat. 3,849,430) and Burri (Helvetica Chimica Acta, Vol. 72 (1989)) are not sufficient to render the present invention obvious, either taken individually, or in combination with each other and/or the other cited references. Applicant recognizes that Lewis et al. (U.S. Pat. 3,849,430) disclose, generally, a process for the preparation of substituted 3-isothiazolones which involves reacting a disulfide-amide or a mercapto-amide with a halogenating agent. As discussed with respect to the disclosure of Hahn et al., however, Lewis et al. do not teach the use of a solvent in which hydrogen chloride is insoluble or has a low solubility. Although Lewis et al. disclose the process of triturating hydrochloride with water (see Col. 7, Example 9), this process is incomparable to the method of the present invention, as indicated by the relatively low yield 73% attained (See Col 7, Example 9). Again, the unexpected superior yield provided by the method of the present

invention, i.e. >99.9% clearly indicates that the present invention was not obvious to those of ordinary skill in the art at the time the invention was made. The Examiner should recognize that it is improper create a hindsight reconstruction of the state of the art existing at the time the referenced patent was filed. Thus, the disclosure of Lewis et al. taken alone or in combination with the other cited references, do not teach a process of preparing 2-alkyl-4-isothiazoline-3-one or a compound equivalent thereto that would have rendered the method of the present invention obvious to one or ordinary skill in art.

Contrary to the Examiner's suggestion, the Burri reference also does not render the present invention obvious, either alone or in combination with the other cited references. The Examiner has claimed that the method of the present invention is disclosed in Scheme 2 (see page 1417, 2nd paragraph, process 15b-16b) and on page 1422. Although Scheme 2 shows 2-alkyl-4-isothiazoline-3-one is shown as an intermediary in the production of the dipolarophiles of 13a-c and 14a-b, Burri, taken alone or in combination with the other cited references, provides does not teach the use a solvent in which the solubility of hydrogen chloride is under 0.04 in molar fraction at normal temperature/pressure. Nor does Burri, alone or in combination with the other cited references, teach the use a selective ratio of chlorinating agent to formula (I) or formula (II), as disclosed in claim 1, lines 23-25 of the present application, or disclose that in so doing, a yield of >99.9 mol % of 2-alkyl-4-isothiazoline-3-one is attainable. Burri, alone or in combination with the other cited references, does not disclose a method of making 2-alkyl-4-isothiazoline-3-one that would have rendered the method of the present invention obvious in view thereof.

The Examiner has further alleged that the difference between some of the process of the prior art and the process instantly claimed is that of generic description of the reactants and/or products. The Examiner's position is, therefore, that the alleged indiscriminate selection of "some" among many is prima facie obvious and that the motivation to make the claimed compounds derives from the expectation that structurally similar compounds would possess similar activity (i.e., a biocide). To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine the teachings. Second, there must be reasonable expectation of success. Finally, the prior art reference (or references combined) must teach or suggest all the

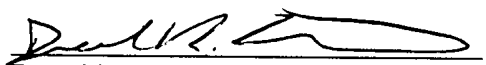
claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must be found in the prior art, and not based on applicant's disclosure. 20 USPQ.2d 1438 (Fed. Cir. 19991).

In reviewing the cited references, Applicants' presume that the Examiner, by this statement, is referring to the general description of the constituents designated "R" in formula (I), (II), and (III), of the instant application, that are described as representing C1 to C8 alkyl groups or aralkyl groups; and/or the statement that "there is no specific limitation on the chlorinating agent used in the reaction." (See page 8, line 16-24). Applicants do not dispute the general notion that structurally similar compounds are presumed to possess similar activity. Applicants' primary inventive concept, however, does not reside in the structure of the products and reactants per se. Rather, as earlier stated, the novelty of the present invention is the selective use of solvents in which hydrogen chloride is insoluble and use of the selected solvent and reactants, namely formulas (I) and (II), as described in the application, in a specified ratio, as described in claim 1. Clear that the cited references, taken alone or combined, fail to teach or suggest all the claim limitations.

In view of the foregoing, Applicants respectfully submit that the present application is now in condition for allowance. The Examiner reconsideration and withdraw of the present rejections is respectfully requested. An early Notice of Allowance is courteously solicited.

Should the Examiner believe that there a further issues remaining to be resolved to place the application in condition for allowance, she is invited to contact the undersigned.

Respectfully submitted,



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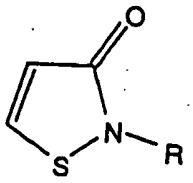
VERSION WITH MARKINGS TO SHOW CHANGES MADE

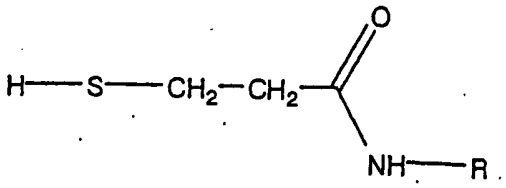
IN THE CLAIMS:

Please amend claims 1, 4, 8, 12, and 16 to read as follows:

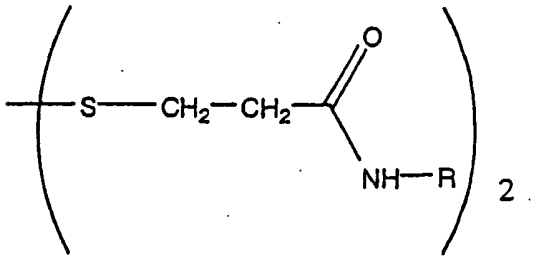
1. (Amended). A method of producing 2-alkyl-4-isothiazoline-3-one represented by the general formula (III),



[(wherein R represents Cl to C8 alkyl groups or aralkyl groups) characterized by the fact that] wherein the compound represented by formula (I),



[(wherein R has the same significance as in aforementioned formula III))] or alternatively, the compound represented by formula (II),



[(wherein R has the same significance as in aforementioned formula (III))] is reacted with a chlorinating agent in a solvent in which hydrogen chloride is insoluble or has low solubility [with a chlorinating agent with a ratio of two mol equivalents of chlorinating agent per

mol of the compound of formula (I) or three mol equivalents of chlorinating agent per mole of compound of formula (II).],

wherein the molar-equivalent ratio of said chlorinating agent to the compound of formula (I) is 3:1, or alternatively,

wherein the molar-equivalent ratio of said chlorinating agent to said the compound of formula (II) is 2:1; and

wherein R in the compounds of formulas (I), (II), and (III) represents C1 to C8 alkyl groups or aralkyl groups.

4. (Amended) The method of producing 2-alkyl-4-isothiazoline-3-one stated in Claim 3 in which aforementioned solvent is selected from at least one of the following: Dichloromethane, dichloroethane, trichloroethane, tetrachloroethane, chloroform, carbon tetrachloride, monochlorobenzene, dichlorobenzene, pentane, hexane, cyclohexane, heptane, and octane.

8. (Amended) The method of producing 2-alkyl-4-isothiazoline-3-one stated in Claims 7 in which aforementioned solvent is selected from at least one of the following: Dichloromethane, dichloroethane, trichloroethane, tetrachloroethane, chloroform, carbon tetrachloride, monochlorobenzene, dichlorobenzene, pentane, hexane, cyclohexane, heptane, and octane.

12. (Amended) The method of producing 2-alkyl-4-isothiazoline-3-one stated in Claim 11 in which aforementioned solvent is selected from at least one of the following: Dichloromethane, dichloroethane, trichloroethane, tetrachloroethane, chloroform, carbon tetrachloride, monochlorobenzene, dichlorobenzene, pentane, hexane, cyclohexane, heptane, and octane.

16. (Amended) The method of producing 2-alkyl-4-isothiazoline-3-one stated in Claim 15 in which aforementioned solvent is selected from at least one of the following: Dichloromethane, dichloroethane, trichloroethane, tetrachloroethane, chloroform, carbon

tetrachloride, monochlorobenzene, dichlorobenzene, pentane, hexane, cyclohexane, heptane, and octane.